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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
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10/698,427

11/03/2003

Hideki Muto

36856.1161

1524

7590

04/24/2006

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EXAMINER

SUMMONS, BARBARA

ART UNIT

PAPER NUMBER

2817

DATE MAILED: 04/24/2006

Please find below and/or attached an Office communication concerning this application or proceeding.

**Office Action Summary**

Application No.

10/698,427

Applicant(s)

MUTO ET AL.

Examiner

Barbara Summons

Art Unit

2817

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

**Period for Reply**

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

**Status**

- 1) ☒ Responsive to communication(s) filed on 03 November 2003 (pre-amend.).
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

**Disposition of Claims**

- 4) ☒ Claim(s) 9-20 is/are pending in the application.
- 4a) Of the above claim(s) \_\_\_\_\_ is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 9, 10, 12, 13 and 15-20 is/are rejected.
- 7) ☒ Claim(s) 11 and 14 is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

**Application Papers**

- 9) ☒ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 03 November 2003 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

**Priority under 35 U.S.C. § 119**

- 12) ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☒ All b) ☐ Some \* c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
  2. ☒ Certified copies of the priority documents have been received in Application No. 09/603,252.
  3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

\* See the attached detailed Office action for a list of the certified copies not received.

**Attachment(s)**

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☒ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)  
Paper No(s)/Mail Date 11/3/03 & 9/20/05.

- 4) ☐ Interview Summary (PTO-413)  
Paper No(s)/Mail Date. \_\_\_\_\_
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other: \_\_\_\_\_

## DETAILED ACTION

### *Specification*

1. The disclosure is objected to because of the following informalities:

The amendment to the specification inserting the Continuation parent application information must be updated by changing "currently pending" to - - now U.S. Patent No. 6,731,184 - -. Appropriate correction is required.

### *Claim Objections*

2. Claims 10, 11, 16 and 17 are objected to because of the following informalities:

In claim 10, on line 3 thereof, "the capacitor" should be changed to - - a capacitor - - since a capacitor "provided adjacent to the antenna" has not been previously recited, but only the capacitor adjacent the reception circuit terminal has been previously recited (see claim 9, the last to lines thereof).

Similarly, in claim 11, on line 3 thereof, "the capacitor" should be changed to - - a capacitor - - since a capacitor "adjacent to the transmission circuit terminal" has not been previously recited.

For the same reasons, in claim 16, on line 3 thereof, "the capacitor" should be changed to - - a capacitor - -; and

In claim 17, on line 3 thereof, "the capacitor" should be - - a capacitor - -. Appropriate correction is required.

### *Claim Rejections - 35 USC § 112*

3. The following is a quotation of the second paragraph of 35 U.S.C. § 112:

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

4. Claims 15-20 are rejected under 35 U.S.C. § 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

Claim 15, recites "a first LC filter" which is "provided between the reception circuit terminal and a capacitor provided adjacent to the reception circuit terminal" (see the last four lines of the claim). However, the location of the LC filter and the elements that comprise the LC filter are unclear because, for example, looking at Fig. 4, all of the capacitors C60 and C70 are part of the LC filter LC30 such that there is not another "capacitor provided adjacent to the reception circuit terminal". Additionally, if one considers the capacitor C70 to be the capacitor located adjacent the reception circuit terminal, then the LC filter is not "between the reception circuit terminal and" the capacitor C70, but is rather between the capacitor C70 and the switch elements. If one considers the capacitor C60 to be the capacitor adjacent the reception circuit terminal, then the LC filter is only C70 and L60, with the inductor L50 being totally separated from the LC filter. Clarification is required.

Each of claims 16 and 17 recite similarly unclear subject matter for second LC filters located either at the antenna terminal or the transmission circuit terminal. For purposes of any art rejections that follow any LC filter capable of performing the recited function (i.e. a high pass filter), will be considered to anticipate the claims.

Clarification is required.

***Claim Rejections - 35 USC § 103***

5. The following is a quotation of 35 U.S.C. § 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

6. Claims 9, 12, 15 and 18 are rejected under 35 U.S.C. § 103(a) as being unpatentable over either one of Erickson U.S. 5,054,114 (of record, cited by Applicants) or Todoroki et al. JP 3-32118, in view of Chigodo et al. U.S. 5,473,293 (of record, cited by Applicants).

The figure of Erickson discloses a high frequency switching component for being connected to a transmission circuit 12, a reception circuit 14 and an antenna 10, the switching component comprising: a high frequency switch including an inductor L1, a capacitor C1 and a diode SW1 and SW2 for switching between states in which either the transmission circuit or the reception circuit is connected to the antenna; a plurality of terminals including a ground terminal (shown schematically), a transmission circuit

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terminal 22 (could also be considered the node 20), a reception circuit terminal 30 (could also be considered the node above SW2) and an antenna terminal (not specifically numbered) to be connected to ground, the transmission circuit, reception circuit and antenna, respectively; and a first LC filter 24 that includes a first inductor L2, and the LC filter is a high pass filter such that it, and thus the inductor L2, inherently eliminates an electrostatic surge or discharge occurring on the signal line because it has low impedance to ground at low frequencies; and wherein the first inductor L2 is connected to the ground terminal and is provided between the reception circuit terminal 30 and a capacitor C5 provided adjacent to the reception circuit terminal 30 such that the first LC filter is also in the location recited, as far as the claims can be understood. Note that if another capacitor is required, Erickson also discloses providing a multi-stage high pass filter (see col. 3, lines 52-57). Also, because the first inductor L2 is connected to ground, the first LC filter 24 that includes the first inductor is considered "connected to ground".

Similarly, Fig. 1 of Todoroki et al. discloses a high frequency switch component for being connected to a transmission circuit (not shown), a reception circuit (not shown) and an antenna 3, the switching component comprising: a high frequency switch including an inductor L1, a capacitor C1 and a diode D1 for switching between states in which either the transmission circuit or the reception circuit is connected to the antenna; a plurality of terminals including a ground terminal (shown schematically), a transmit circuit terminal 12 (note the transmit signal Et), a receive circuit terminal 13 (see receive signal Er) and an antenna terminal (not numbered) to be connected to ground, the

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transmission circuit, reception circuit and antenna, respectively; and a first LC filter 2a that includes a first inductor L3, and the LC filter is a high pass filter such that it, and thus the inductor L3, inherently eliminates an electrostatic surge or discharge occurring on the signal line because it has low impedance to ground at low frequencies; and wherein the first inductor L3 is connected to the ground terminal and is provided between the reception circuit terminal 13 and a capacitor C2 provided adjacent to the reception circuit terminal 13 such that the first LC filter is also in the location recited, as far as the claims can be understood. Also, because the first inductor L3 is connected to ground, the first LC filter 2a that includes the first inductor is considered "connected to ground".

However, neither of the Erickson or Todoroki references discloses a multilayer circuit board with the plurality of terminals being disposed on the surface thereof.

Figs. 1 and 2 of Chigodo et al. disclose a multilayer antenna switch with a transmission terminal TX(52f), reception terminal RX(52j), antenna terminal ANT(52c) and ground terminal (52k)[see also grounding electrode 50 in Fig. 2G] all disposed on a surface of the multilayer circuit board. This multilayer structure provides the advantage of being small in size over alternative arrangements (see col. 2, lines 15-35).

Consequently, it would have been obvious to one of ordinary skill in the art at the time the invention was made to have modified the high frequency switch component of either one of Erickson or Todoroki et al., if even necessary, such that it would have been formed on a multilayer circuit board as suggested by the exemplary teaching of Chigodo et al., because each of Erickson and Todoroki et al. is silent as to the physical

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structure of its circuit, thereby suggesting to one of ordinary skill that any well known physical structure, such as on/in a multilayer circuit board, would have been usable therewith, and because such an obvious modification would have provided the advantageous benefit of a small sized switch as suggested by Chigodo et al. (see col. 2, lines 15-35).

7. Claims 10, 13, 16 and 19 are rejected under 35 U.S.C. § 103(a) as being unpatentable over either Erickson/Chigodo et al. or Todoroki et al./Chigodo et al. as applied to claims 9 and 15 above, and further in view of the Fukushima et al. IEEE article "A Study of SAW Antenna Duplexer For Mobile Application" (of record, cited by Applicants).

Each of the Erickson/Chigodo and Todoroki/Chigodo combinations discloses the invention as discussed above, except for a second inductor or second LC filter located at the antenna terminal for eliminating an electrostatic surge.

Fukushima et al. discloses that it is well known to protect transmission and reception filter circuits in a duplexer from electrostatic discharge/surge entering the signal line from the antenna [see page 11, in box and Fig. 5(b)] by providing an LC high pass filter that includes an inductor connected to ground between the antenna and a capacitor located adjacent the antenna so that the surge will go to ground via the inductors (ibid.) This circuit will inherently provide elimination of an electrostatic surge with a frequency lower than the signal line from the antenna because it has low impedance to ground at low frequencies.



Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to have modified either one of the Erickson/Chigodo and Todoroki/Chigodo combinations by having provided an electrostatic surge protection LC filter with an inductor connected to ground as suggested by the exemplary teaching of Fukushima et al. [see Fig. 5(b)], because such an obvious modification would have provided the advantageous benefit of protecting the switch and reception and transmission circuits from electrostatic discharge/surge from the antenna as suggested by Fukushima et al. (see page 11, in the box).

#### ***Allowable Subject Matter***

8. Claims 11 and 14 are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

9. Claims 17 and 20 would be allowable if rewritten to overcome the rejection(s) under 35 U.S.C. 112, 2nd paragraph, set forth in this Office action and to include all of the limitations of the base claim and any intervening claims.

#### ***Conclusion***

10. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure.

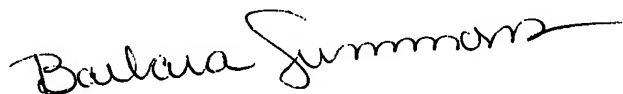
Muto et al. U.S. 6,731,184 is the U.S. Patent that issued from the parent application.

11. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Barbara Summons whose telephone number is (571) 272-1771. The examiner can normally be reached on M-Th, M-Fr.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Bob Pascal can be reached on (571) 271-1769. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

bs  
April 19, 2006



**BARBARA SUMMONS  
PRIMARY EXAMINER**



Substitute for form 1449/PTO

# INFORMATION DISCLOSURE STATEMENT BY APPLICANT

(Use as many sheets as necessary)

Sheet 1 of 2

## Complete if Known

Application Number 10/698,427  
 Filing Date 11/3/03  
 First Named Inventor Hideki MUTO  
 Art Unit 2817  
 Examiner Name Barbara Summons  
 Attorney Docket Number 36856.1161

## U.S. PATENT DOCUMENTS

Class/Subclass

Examiner Initials*	Cite No. <sup>1</sup>	Document Number Number-Kind Code 2(if known)	Publication Date MM -YYYY	Name of Patentee or Applicant of Cited Document	Pages, Columns, Lines, Where Relevant Passages or Relevant Figures Appear
BS	1	6,289,204 B1	09/2001	ESTES et al.	455/78
BS	2	5,473,293	12/1995	CHIGODO et al.	333/104
BS	3	5,054,114	10/1991	ERICKSON	455/78

## FOREIGN PATENT DOCUMENTS

Examiner Initials*	Cite No. <sup>1</sup>	Foreign Patent Document Country Code <sup>2</sup> Number-Kind Code 4(if known)	Publication Date MM -YYYY	Name of Patentee or Applicant of Cited Document	Pages, Columns, Lines, Where Relevant Passages or Relevant Figures Appear	T <sup>3</sup>
BS	4	JP 62-198727	12/1987	JAPAN		X
BS	5	JP 4-132751	12/1992	JAPAN		X
BS	6	JP 5-258550 JP 5-258550	04/1993	JAPAN		X
BS	7	JP 7-202502	08/1995	JAPAN		X
BS	8	JP 9-200077	07/1997	JAPAN		X

Examiner  
Signature

Barbara Summons

Date  
Considered

4/14/06

\* Examiner: Initial if reference considered, whether or not citation is in conformance with MPEP 609. Draw line through citation if not in conformance and not considered, include copy of this form with next communication to applicant.

<sup>1</sup> Applicant unique citation designation number (optional). <sup>2</sup> See Kind Codes of USPTO Patent documents at [www.uspto.gov](http://www.uspto.gov) or MPEP 901.04. <sup>3</sup> Enter Office that issued the document by the two-letter code (WIPO Standard ST.3). <sup>4</sup> For Japanese patent documents, the indication of the year of the reign of the Emperor must precede the serial number of the patent document. <sup>5</sup> Kind of document by the appropriate symbols as indicated on the document under WIPO Standard ST. 16 if possible. <sup>6</sup> Applicant is to place a check mark here if English language Abstract is attached. This collection of information is required by 37 CFR 1.97 and 1.98. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14.

Also  
Cited on  
IDS of  
9/20/05

(Use as many sheets as necessary)

Sheet	2	of	2
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Application Number	10/698,427
Filing Date	11/3/03
First Named Inventor	Hideki MUTO
Art Unit	2817
Examiner Name	Barbara Summons
Attorney Docket Number	36856 1161

[illegible]

4/14/06

<sup>1</sup> Applicant unique citation designation number (optional). <sup>2</sup> Applicant is to place a check mark here if English language Translation is attached. This collection of information is required by 37 CFR 1.97 and 1.98. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14.

<b>Notice of References Cited</b>	Application/Control No. 10/698,427	Applicant(s)/Patent Under Reexamination MUTO ET AL.	
	Examiner Barbara Summons	Art Unit 2817	Page 1 of 1

**U.S. PATENT DOCUMENTS**

*		Document Number Country Code-Number-Kind Code	Date MM-YYYY	Name	Classification
*	A	US-6,731,184	05-2004	Muto et al.	333/103
	B	US-			
	C	US-			
	D	US-			
	E	US-			
	F	US-			
	G	US-			
	H	US-			
	I	US-			
	J	US-			
	K	US-			
	L	US-			
	M	US-			

**FOREIGN PATENT DOCUMENTS**

*		Document Number Country Code-Number-Kind Code	Date MM-YYYY	Country	Name	Classification
	N	JP 3-32118	02-1991	Japan	Todoroki et al.	455/83
	O					
	P					
	Q					
	R					
	S					
	T					

**NON-PATENT DOCUMENTS**

*		Include as applicable: Author, Title Date, Publisher, Edition or Volume, Pertinent Pages)
	U	
	V	
	W	
	X	

\*A copy of this reference is not being furnished with this Office action. (See MPEP § 707.05(a).)  
Dates in MM-YYYY format are publication dates. Classifications may be US or foreign.

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L35: Entry 9 of 11

File: JPAB

Feb 12, 1991

PUB-NO: JP403032118A  
DOCUMENT-IDENTIFIER: JP 03032118 A  
TITLE: ANTENNA SWITCH CIRCUIT

JP 3-32118

PUBN-DATE: February 12, 1991

INVENTOR-INFORMATION:

NAME

COUNTRY

TODOROKI, HIDEFUMI

TEZUKA, YOSHIHIKO

ASSIGNEE-INFORMATION:

NAME

COUNTRY

NAGANO JAPAN RADIO CO

APPL-NO: JP01166160

APPL-DATE: June 28, 1989

US-CL-CURRENT: 455/83  
INT-CL (IPC): H04B 1/44

ABSTRACT:

PURPOSE: To improve the overall selectivity characteristic and to save number of diodes in use by providing an impedance circuit acting like a high pass filter through the provision of a reception switching signal.

CONSTITUTION: Since a reception switching signal  $S_r$  whose polarity is negative to an input terminal 12 and positive to an input terminal 11b is given at the reception and a diode D1 is reverse-biased, a reception signal received by an antenna 3 is fed to a reception terminal 13 in the path of the arrow  $E_r$ . In this case, capacitors C1, C2 and coils L1-L3 being components of the impedance circuit 2 act like 2-stage of high pass filter 2a and the high pass filter 2a acts like a band pass filter together with a low pass filter connecting to an antenna 3. Thus, a reception signal at the reception passes the band pass filter, the entire selectivity characteristic is improved and the function of a clipper diode is used in common by an antenna switch diode D2, then number of diodes is reduced.

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⑫ 公開特許公報(A)

平3-32118

⑤ Int. Cl.<sup>3</sup>

H 04 B 1/44

識別記号

庁内整理番号

7189-5K

⑬ 公開 平成3年(1991)2月12日

審査請求 未請求 請求項の数 2 (全4頁)

⑭ 発明の名称 アンテナスイッチ回路

⑯ 特 願 平1-166160

⑰ 出 願 平1(1989)6月28日

⑱ 発 明 者 轟 秀 文 長野県長野市大字鶴賀西鶴賀町1463番地 長野日本無線株式会社内

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⑳ 出 願 人 長野日本無線株式会社 長野県長野市大字鶴賀西鶴賀町1463番地

㉑ 代 理 人 弁理士 下 田 茂

明 細 書

1. 発明の名称

アンテナスイッチ回路

2. 特許請求の範囲

(1) インピーダンス回路を備え、受信用切換信号の付与により、前記インピーダンス回路をフィルタとして機能させ、アンテナから受信可能に切換えたとともに、送信用切換信号の付与により、前記インピーダンス回路を高インピーダンス回路として機能させ、アンテナから送信可能に切換えるアンテナスイッチ回路において、受信用切換信号の付与により、ハイパスフィルタとして機能するインピーダンス回路を設けてなることを特徴とするアンテナスイッチ回路。

(2) 受信用切換信号の付与により、前記インピーダンス回路をハイパスフィルタとして機能させ、かつアンテナに接続したローパスフィルタと共に、バンドパスフィルタとして機能させることを特徴とする請求項1記載のアンテナスイッチ回路。

3. 発明の詳細な説明

(産業上の利用分野)

本発明は無線送受信機等に用いるアンテナスイッチ回路に関する。

(従来の技術)

一般に、アンテナを共用する無線送受信機においては、一本のアンテナに対して送信機能と受信機能を切換えるアンテナスイッチ回路を備えている。

従来のアンテナスイッチ回路を第3図に符号30で示す。

同回路30はインピーダンス回路31を備え、切換信号入力端子32aが(+)、32bが(-)となる送信用切換信号を付与すれば、矢印1bに沿って電流が流れる。この結果、コイルL10は接地状態となり、コンデンサC10とコイルL10による共振回路33が形成されるため、インピーダンス回路31はダイオードD11のカソード側から見ると高インピーダンス回路となり、送信信号は矢印Htに沿って送信端子35からア



ンテナ36に供給される。

一方、切換信号入力端子32aが(-)、32bが(+)となる受信用切換信号を付与すれば、ダイオードD10が逆バイアスされるため、インピーダンス回路31におけるコイルL10、L11、コンデンサC10、C11、C12により二段のローパスフィルタ31aとして機能し、受信信号は矢印Hrに沿ってアンテナ36からローパスフィルタ31aを通して受信端子37に供給される。

なお、D12、D13は過大受信入力をクリップさせるクリッパ用ダイオード、38はアンテナ36に接続したローパスフィルタを示す。

(発明が解決しようとする課題)

ところで、上述した従来のアンテナスイッチ回路30は、受信時におけるインピーダンス回路31はローパスフィルタ31aとして機能し、結局、アンテナスイッチ回路30の総合フィルタ特性は第2図に示すように、同フィルタ31aによる特性P1とアンテナ36に接続したローパスフィル

タ38による特性P2によって符号P3のようになる。このため、ローパスフィルタとしての特性は向上するが、選択度については十分とはいえず、特に、受信ローカルが受信周波数よりも、より低い周波数帯域に存在する場合には第1イメージ周波数が第1IF周波数の2倍分だけ受信周波数よりも低い周波数となり、また、受信周波数よりも低い周波数帯域に大電力局が存在する場合にもまわめて不利となる。しかも、ダイオードの使用数量が多くなり、回路的にも不利になる問題があった。

本発明はこのような従来の技術に存在する課題を解決したアンテナスイッチ回路の提供を目的とするものである。

(課題を解決するための手段)

本発明に係るアンテナスイッチ回路1はインピーダンス回路を備え、受信用切換信号Srの付与により、前記インピーダンス回路をフィルタとして機能させ、アンテナ3から受信可能に切換えるとともに、送信用切換信号Stの付与により、

前記インピーダンス回路を高インピーダンス回路として機能させ、アンテナ3から送信可能に切換えるスイッチ回路を構成するに際して、受信用切換信号Srの付与により、ハイパスフィルタ2aとして機能するインピーダンス回路2を設けてなることを特徴する。なお、この場合、インピーダンス回路2はアンテナ3に接続したローパスフィルタ4と共に、バンドパスフィルタとして機能させることが望ましい。

(作 用)

本発明に係るアンテナスイッチ回路1によれば、受信用切換信号Srを付与することにより、インピーダンス回路2はハイパスフィルタ2aとして機能し、受信周波数よりも低い周波数帯域は遮断される。また、ハイパスフィルタ2aはアンテナ3に接続したローパスフィルタ4と共に、バンドパスフィルタとして機能し、アンテナスイッチ回路1の総合選択度特性を向上させる。

(実施例)

以下には、本発明に係る好適な実施例を挙げ、

図面に基つき詳細に説明する。

まず、本発明に係るアンテナスイッチ回路1の構成について第1図を参照して説明する。

3はアンテナであり、ローパスフィルタ4、カップリングコンデンサC3を介して共通接続点Xに接続する。また、11a、11bは切換信号の入力端子であり、一方の入力端子11aは抵抗R1、チョークコイルL2、ダイオードD1を介して接続点Xに接続するとともに、他方の入力端子11bはコイルL1を介して接続点Xに接続する。そして、送信端子12をカップリングコンデンサC4を介してコイルL2とダイオードD1の接続部に接続する。さらに、共通接続点XにはコンデンサC1、C2を介して受信端子13を接続する。コンデンサC1とC2の接続部はコイルL2、抵抗R2を介して前記入力端子11aに接続するとともに、同接続部と接地間には極性が反対となる一対のダイオードD2とD3を並列接続し、また、コンデンサC2と受信端子13の接続部はコイルL3を介して接地する。なお、C5、C6、

C 7は適宜接続したバイパスコンデンサを示す。  
また、二点鎖線で囲った回路はインピーダンス回路2を構成する。

次に、本発明に係るアンテナスイッチ回路1の機能について説明する。

まず、送信時には入力端子11aが(+)、11bが(-)となる受信用切換信号S<sub>t</sub>が付与され、矢印1e及び1fの二経路に電流が流れる。この結果、インピーダンス回路2におけるコイルL1とコンデンサC1は共振回路を形成し、共通接続点Xからみて受信端子13側は高インピーダンス回路となる。よって、送信端子12に入力する送信信号は矢印E<sub>t</sub>の経路でアンテナ3に供給される。

一方、受信時には入力端子11aが(-)、11bが(+)となる受信用切換信号S<sub>r</sub>が付与される。受信時にはダイオードD1が逆バイアスされるため、アンテナ3で受信する受信信号は矢印E<sub>r</sub>の経路で受信端子13に供給される。この際、インピーダンス回路2を構成するコンデンサC1、

C2とコイルL1、L2、L3は二段のハイパスフィルタ2aとして機能する。

ところで、アンテナ3にはローパスフィルタ4が接続されているため、このローパスフィルタ4によるフィルタ特性は第2図中特性P2となり、また、ハイパスフィルタ2aによるフィルタ特性は同図中特性P4となるため、結局、特性曲線が実線で示す特性P0となるバンドパスフィルタとして機能する。即ち、本発明に係るアンテナスイッチ回路1によれば、受信時には受信信号がバンドパスフィルタを通過し、全体の選択度特性は大きく向上する。

なお、クリップ用ダイオードの機能をアンテナスイッチ用のダイオードD2が兼用するため、従来回路(第3図参照)に比べてダイオードは一本不要となる。

以上、実施例について詳細に説明したが、本発明はこのような実施例に限定されるものではない。例えば、アンテナに接続するローパスフィルタはなくてもよい。また、インピーダンス回路は二段

のフィルタとして機能する場合を示したが他の段数であってもよい。その他、細部の構成等において本発明の要旨を逸脱しない範囲で任意に変更できる。

(発明の効果)

このように、本発明に係るアンテナスイッチ回路は受信用切換信号の付与により、ハイパスフィルタとして機能するインピーダンス回路を設けるため、アンテナスイッチ回路における総合の選択度特性が大きく向上するとともに、ダイオードの使用数量を削減でき、回路上有利となる効果を奏する。

#### 4. 図面の簡単な説明

第1図：本発明に係るアンテナスイッチ回路の電気回路図、

第2図：同アンテナスイッチ回路におけるフィルタ特性図、

第3図：従来の技術に係るアンテナスイッチ回路の電気回路図。

尚図面中、

1：アンテナスイッチ回路

2：インピーダンス回路

2a：ハイパスフィルタ

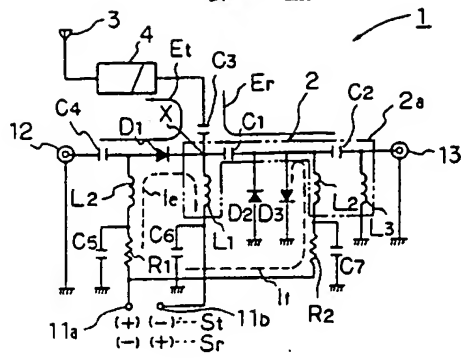
3：アンテナ

4：ローパスフィルタ

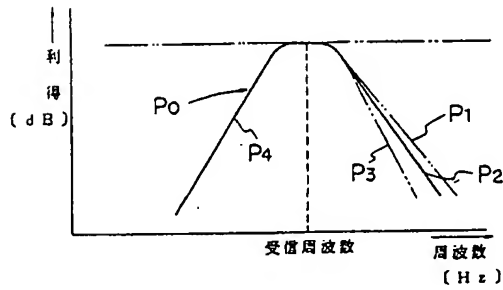
S<sub>r</sub>：受信用切換信号 S<sub>t</sub>：送信用切換信号

特許出願人 長野日本無線株式会社  
代理人 弁理士 下 田 茂

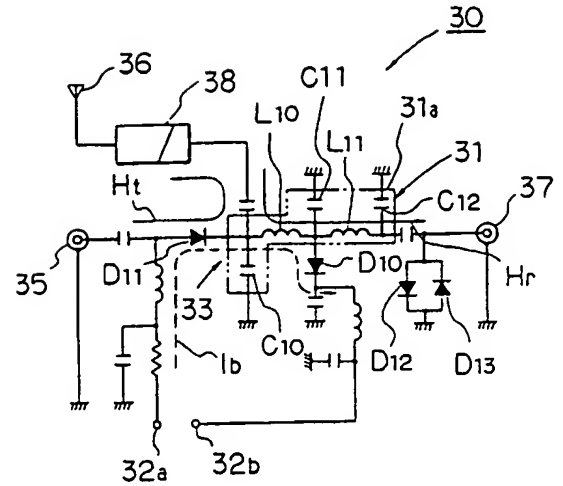
第1図



第2図



第3図



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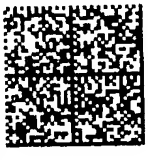
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